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Structural Design Philosophy

For

Residence at Pallavaram,Chennai

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Revision Index

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1.0 GENERAL INFORMATION

NAME OF PROJECT	:	**Residential at Pallavaram**
LOCATION OF PROJECT	:	**CHENNAI**
NAME OF OWNER	:	**CASAGRAND BUILDER PRIVATE LIMITED**
NAME AND ADDRESS OF ARCHITECTS	:	**LAVANYA AND SHANKAR ARCHITECTS** Baid Metha Complex, C – Block 3rd Floor, Old No. 183, New No. 16, Anna Salai, Saidapet, Chennai – 15
NAME AND ADDRESS OF CONSULTANT	:	**Anagha Prudent Consultants LLP** #114-A, CIL Layout, 2nd Cross, 3rd Main, Sanjaynagar Bangalore – 560 094, India Telephone: +91-80-41313961, www.anaghaprudent.com

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2.0 PROJECT BRIEF

2.1 PROJECT DESCRIPTION.

Casagrand Builder Private Limited are proposed to construct Residential buildings at Pallavaram, Chennai.The proposed development consists of 5 residential Towers and club house. Basement is used for car parking. Residential units starts from ground floor to 5th floor + Terrace floor.

2.2 BUILDING DESIGN DATA.

The details of the Towers to be constructed are as follows.

Sr. No	NAME	Approx. Size		Description	No of Floors	Design Consideration
		L (mtr)	W (mtr)			
1	Tower-1	45.31	23.85	Multiple floors RCC framed structure	1B+G+5	1B+G+5
2	Tower-2	25.30	26.03	Multiple floors RCC framed structure	1B+G+5	1B+G+5
3	Tower-3	72.05	19.83	Multiple floors RCC framed structure	1B+G+5	1B+G+5
4	Tower-4	78.65	23.86	Multiple floors RCC framed structure	1B+G+5	1B+G+5
5	Tower-5	54.08	22.18	Multiple floors RCC framed structure	1B+G+5	1B+G+5

The Seperation joints are provided in Tower and podium portion.

Height of typical Floor is 2950mm and Basement is 3800mm.

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3.0 STRUCTURAL DESIGN CRITERIA

3.1 DESIGN BRIEF:

The material chosen for the structural elements in the building is reinforced concrete. Concrete is homogeneous in nature with good strength for compressive forces. Concrete also has a good resistance to fire and weather.

Column/beam - Slab system is proposed for the proposed Towers. Shear walls will be arranged in basements, typical floors based on functional and economical considerations for supporting of above floors. Shear walls are used in resisting lateral loads caused by Wind and Earthquake.

The grade of concrete shall be as per Design requirement & Reinforcement steel shall be with a yield stress of **550** N/mm². Also lean concrete with strength of 10 N/mm² (M-10) shall be used for levelling course.

Shear wall shapes shall be rectangular and the sizes shall depend upon the detailed analysis & design, considering the optimum utilization of steel & concrete.

SUPER STRUCTURE:

Super structure of the building is slab column/beam system with columns, shear and lift cores as RCC walls. The beams are arranged based on architectural requirement. Continuity of slabs are considered wherever possible for design of slabs.

Slab thickness 125mm thick unless mentioned otherwise as per shown in drawing.

SUB STRUCTURE:

Sub structure consists of raft/isolated foundation, which distributes gravity loads & lateral loads from super structure to soil beneath. Allowable bearing pressure on the founding strata is considered for sizing of foundations. Safe bearing capacity (SBC) shall be based on Geotechnical report.

3.2 BASIC ASSUMPTION

1. The building shall be designed as one rigid monolithic structure.
2. Sizes of structural elements have been provided for optimal design of maximum stress.
3. Load carrying capacity of compression members increases with higher grade of concrete mix. Therefore to achieve economy and reduced size of columns, shear wall, higher grade of concrete is proposed.

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4. Grade of concrete for beams and slabs where flexural strength shall be basis of design, grade M-30 concrete shall be proposed.
5. Continuity of structural members is very much desirable since it will provide multiple path of load resistance. Therefore as far as possible all parts of building are tied together to act as one unit in resisting external forces.
6. The floor slabs shall be considered as horizontal diaphragms and stiff enough in their planes to produce equal lateral displacement of all shear walls at a given floor level.
7. Concrete behaves elastically linear and therefore the structure shall be amenable to a linear method of analysis involving super-position of actions and displacements.
8. The cladding and other non-structural components do not influence the behaviour of the building against lateral loads.
9. The out of plane action of slabs are disregarded for lateral load analysis.
10. Temperature Analysis is considered for the **PODIUM and TERRACE ONLY.**
11. Project is located at a distance of 12 kms from sea shore(Merina Beach).

3.3 LIMIT STATE METHOD OF DESIGN

Limit state method of design has become common method. In view of this, all structural elements of the building shall be designed with "LIMIT STATE METHOD" as per Indian standards.

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3.3.1 LOAD COMBINATIONS

The following load Combinations shall be used for the structural load analysis

Load Combinations		Remarks
1.5 (DL+LL)		**DL** = Dead Load on the Structure **LL** = Live Load on the structure **RSPX** = Earthquake Load along X direction **RSPY** = Earthquake Load along Y direction **WX** = Wind Load along X direction **WY** = Wind Load along Y direction
1.5 (DL± RSPX)	1.5 (DL ± WX)	
1.5 (DL ± RSPY)	1.5 (DL ± WY)	
(0.9 DL ± 1.5 RSPX)	(0.9DL ± 1.5 WX)	
(0.9 DL ± 1.5 RSPY)	(0.9DL ± 1.5 WY)	
1.2 (DL+ LL ± RSPX)	1.2 (DL+ LL ± WX)	
1.2(DL + LL ± RSPY)	1.2 (DL+ LL ± WY)	

Load Combinations for Limit State of Serviceability	
1.0 (DL+LL)	
1.0 (DL± RSPX)	1.0 (DL ± WX)
1.0 (DL ± RSPY)	1.0 (DL ± WY)
DL + 0.8 (LL ±RSP X)	DL+0.8(LL ± WX)
DL + 0.8(LL ± RSPY)	DL + 0.8(LL ± WY)

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3.3.2 SERVICEABILITY CHECK

This is given with following limitations:

a. For Vertical deflections : Total load deflections = Span / 250

b. Lateral drift of Structure(wind) : = Height / 500

c. Storey drift = 0.004H*

where H = total height of the building
H* = storey height

d. For Cracking

1. For water retaining structure = cracked section, limiting crack width to 0.2 mm

3.3.3 COMPUTER ANALYSIS

All structures shall be analyzed using STAADPro Software / ETABS / SAFE and RCDC.

3.4 DESIGN LOAD DATA

The RCC/Basic frame structure shall be designed considering the dead loads of the following elements.

WALLS

External walls **200mm thick Aerocon block walls**

Internal walls **100mm thick and 200mm thick Aerocon block walls**

SUNKEN SLAB

Toilet Sinking	**100 mm**
Balcony Sinking	**150 mm**
Utility Sinking	**150 mm**
Toilet filling material	**CINDER**

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O.H. WATER TANKS

The R.C.C. over head water tank shall be considered for Potable /Fire & Raw water storage at locations above the staircase headroom. Capacity of tanks considered based on input from MEP consultants.

3.4.1 DEAD LOADS – IS 875: Part 1

The densities of different materials considered for design are as follows:-

Density of reinforced concrete	25 kN/ cu.m
Density of soil	18 kN/ cu.m
Density of steel	78.5 kN/ cu.m
Density of plain concrete	24 kN/ cu.m
Density of finishes / plaster for walls	20.4 kN/ cu.m
Density of Granite	26 kN/ cu.m
Density of aerocon blocks	10 kN/ cu.m
Density of Cinder for filling	8 kN/ cu.m
Density of PCC filling	24 kN/ cu.m
Floor finishes	1.5 kN/sq.m
Terrace level floor finish	2.4 kN/sq.m
Car parking level floor finish	2.4 kN/sq.m
Curtain wall glazing	0.90 kN/sq.m

Wall load = [(2.95-0.5)x0.2x10] + [(2.95-0.5)x0.035x20] = 6.615 kN/m

[(2.95-0.5)x0.1x10] + [(2.95-0.5)x0.035x20] = 4.165 kN/m

3.4.2 LIVE LOADS– IS 875: Part 2

The LIVE loads recommended herein is for UDL (Uniformly Distributed Load) over the Floor.

1. Living, kitchen, Rooms - 2.0 KN/ m^2
2. Staircase, Corridors, Balconies - 3.0 KN/ m^2
3. Toilet Floor - 2.0 KN/ m^2
4. Terrace Floor - 2.0 KN/ m^2

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5. Lift Machine slab - 12.0 KN/ m^2

6. Fire Driveways - 45.0 MT WAGON Load (a unifomly distributed load of 15.0 KN/m^2 is assumed on the slab as equivalent load)

7. Podium slabs - For landscape filling as per Landscape drawings.

8. Gym area - 5.0 KN/ m^2

9. Car parking - 3 KN/ m^2

10. Indoor Games - 3.0 KN/ m^2

11. Party Hall - 5.0 KN/ m^2

12. Lift Lobby - 3.0 KN/ m^2

13. Electrical Room - 7.5 KN/m^2

3.4.3 WIND LOAD – IS:875 Part 3

As per IS.875 part 3 2015 Basic wind speed in Chennai is considered as **50** m / sec.

Risk Coefficient K1	: 1.00 (k1 corresponds to 50 years Mean Probable Design Life of Structure)
Terrain, height, structure size factor K2	: It varies wrt height from 1 to 1.2 (To suit the height of the structure for terrain Category 4 is considered)
Topography factor K3	: 1.00
Importance factor K4	: 1.00
Design wind speed Vz	: Vb x K1 x K2 x K3xK4

Wind loads on cladding / glazing:

For designing the cladding / glazing supports, the wind load will govern the design, for which the above design wind pressure shall be considered with appropriate local pressure coefficient.

3.4.4 SEISMIC LOAD:

1. Sesmic loads shall be calculated as per IS 1893-(Part 1) - 2016.
2. According to the IS: 1893, the Indian Sub-Continent has been divided into four seismic zone. Zone II is zone of "Low Seismic Risk", Zone III is of "Moderate Seismic Risk", Zone IV is of "Severe Seismic Risk", & Zone V is of "Very Severe Seismic Risk".

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3. Chennai comes under Zone III which is of "Moderate Seismic Risk".
4. Various design parameters for seismic analysis, suggested are as follows:
   a. Zone factor (Z) = 0.16
   b. Importance factor for the structure (I) = 1.2
   c. Response reduction factor (R) = 5.0
   d. Soil site factor = Medium

   Period considered for the structure is WITH INFILL and as per Cl 7.6.2.

   Ta = {[0.09h]/√d}
5. For calculating the earthquake force on roofs the live load shall not be considered.
6. The horizontal earthquake force shall be calculated for the full dead load and 25% of live loads.
7. The Dynamic method is used for the analysis of structure.

3.5 CONSTRUCTION MATERIALS.

3.5.1 STEEL

All reinforcing steel shall be **Fe 550** grade with 14.5% elongation.

Y – on all drawings represents high yield strength deformed bars.

3.5.2 CONCRETE

Grade of concrete for shear walls shall be as per design requirement. Grade of concrete of for beams, slabs and all other elements shall be M30.

FOUNDATION, RETAINING WALLS & OTHER CONCRETE BELOW GROUND LEVEL.

Grade of concrete for sub-structural elements shall be as per the design requirements with minimum cement content of **300 Kg/m³** and **330 Kg/m³** for walls of liquid retaining structures.

SLAB & BEAMS

Concrete grade shall be as per the design requirement with minimum cement content of **320 Kg/m³**

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MINIMUM CEMENT CONTENT:

GRADE OF CONCRETE	MIN CEMENT CONTENT
M20 & M25	300 Kg/m^3
M30	320 Kg/m^3
M35	340 Kg/m^3
M40	360 Kg/m^3
M45	380 Kg/m^3

Maximum cement content not to exceed 450 Kg/m^3.

FOUNDATIONS

1. Isolated/Combined/Raft foundation as per the loading and allowable bearing pressure.
2. Maximum allowable Safe Bearing Capacity of soil as per soil report for foundations placed over distintegrated rock as per Geotechnical Investigation report.
3. All loose pockets and soft spots are to be filled in mass concrete of grade M10.
4. All backfilling shall be well compacted to achieve 95% modified dry density. Compaction shall be done in layers of not more than 300mm.
5. Suggested precautions indicated in geotechnical report shall be followed while undertaking the construction activity.
6. Design of foundation / substructure shall be done as per recommendations of geotechnical investigations report and relevant codes of practice / handbooks.

3.5.3 LAP / DEVELOPMENT LENGTH

Lap / Development Length	Fe 500 for bars in Tension	Fe 500 for bars in compression
M20	57x dia.	46x dia.
M25	49x dia.	39x dia.
M30	45 x dia.	36 x dia.
M35	40 x dia.	32 x dia.
M40 & above	36x dia.	36x dia.

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3.5.4 CONCRETE COVER

The structures shall be designed with Clear concrete cover to reinforcement as follows:

Solid slabs	25 mm
Footing	50 mm
Retaining Wall	30 mm on earth side
Beams	40 mm simply supported / 30mm continuous mm
Columns	40 mm
UG and OH Water tanks	30 mm on outer side / 30 mm on water side
Staircase	30 mm
Shear wall	30 mm
Grade Slab	40 mm from top

The structure is designed for 2.0 hr fire rating.

3.5.5 SEPERATION JOINTS

Separation joint is considered between towers and podium.

Membrane/Crystalline water proofing is proposed for retaining walls.

Crysatallisation/Membrane method is proposed for all sunken areas & terrace.

Seperation joint covering in elevation between towers shall be done with Powder Coated aluminium plate with EPDM moisture barrier.

3.6 GENERAL NOTES

1. Structural drawings shall be read and used in conjunction with Architectural, Mechanical, Plumbing, Electrical drawings and project specifications.
2. Unless otherwise noted, details shown on any structural drawings are to be considered typical for all similar conditions.
3. All 'levels' to be read from Architectural drawings & corresponding services drawings.
4. All dimensions in structural drawings, reinforcing bar diameters / spacing of bars are in millimeters.
5. Exposure condition considered for the sub and super structure is moderate as per Table-3 of IS 456.

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3.7 DESIGN CODES AND REFERENCES:

Indian Standard Code of Practice for Design Loads (other than Earthquake) for buildings and structures. IS: 875 (Part 1 DEAD LOADS) 1987.

1. Indian Standard Code of Practice for Design loads (other than Earthquake) for buildings and structures. IS: 875 (Part 2 LIVE LOADS) – 1987.
2. Indian Standard Code of Practice for Design loads (other than Earthquake) for buildings and structures. IS: 875 (Part 3 WIND LOADS) – 2015.
3. Indian Standard Code of Practice for Design loads (other than Earthquake) for buildings and structures. IS: 875 (Part 5 SPECIAL LOADS & COMBINATIONS) – 1987.
4. Indian Standard Plain and Reinforced Concrete. Code of Practice. IS: 456 : 2000.
5. Indian Standard Criteria for Earthquake Resistant Design of Structures IS:1893(Part1) :2016.
6. Indian Standard code of practice for Earthquake Resistant Design and construction of buildings (2nd Revision) IS: 4326 – 1993.
7. Indian Standard Code of practice for concrete structures for the storage of liquids IS: 3370 (Part I&II) – 2009.
8. SP-16 – 1980, Design Aids for reinforced concrete to IS: 456 – 2000.
9. SP: 24 – 1983. Explanatory Hand book on Indian Standard Code of Practice for Plain and Reinforced Concrete to IS: 456 – 2000.
10. Indian standard code of practice for ductile design and detailing of reinforced concrete structure subject to seismic force IS:13920-2016.
11. Indian Standard Hand Book on Concrete Reinforcement and Detailing SP:34(S&T)–1987.
12. Foundation Analysis and Design – Joseph E Bowles – McGraw-Hill Publications.
13. Reinforced Concrete Designer's Hand Book – C.E. Reynolds and James C. Steedman.
14. Hand Book of Concrete Engineering – Mark Fintel – CBS Publishers and Distributors.
15. IS 1904-Indian Standard Code of Practice for design & construction foundation in soil general requirements.
16. IS 2950 - Indian Standard Code of Practice for design & construction of raft foundation (Part-I)

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Property Documentation & Workflow Tools

Forms & Templates, Document Generator, Document Translation, Dictionary

Vastu & Property Management Tools

Home Vastu Shastra, Plot Vastu Shastra, Property Management

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We're honored to be part of your real estate journey

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